Africa Research in Sustainable Intensification for the Next Generation (Africa RISING)

Project Document

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CGIAR

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. http://africa-rising.net/

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List of Accronyms

ARI HOMBOLO	Hombolo Agricultural Research Institute
AVRDC	The World Vegetable Center
CGIAR	Consortium of International Agricultural Research Centers
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CKAN	Comprehensive Knowledge Archive Network
COUNSENUTH	The Centre for Counselling, Nutrition and Health Care
ESA	East and Southern Africa
FTF	Feed the Future
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid-Tropics
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
ISFM	Integrated Soil Fertility Management
LUANAR	Lilongwe University of Agriculture and Natural Resources
M&E	Monitoring and Evaluation
MSU	Michigan State University
NARS	National Agricultural Research System
NMAIST	Nelson Mandela African Institution of Science and Technology
PCT	Program Communication Team
PI	Principal Investigator
PMMT	Project Mapping and Monitoring Tool
PSC	Project Steering Committee
R4D	Research for Development
RO	Research Output
SAG	Science Advisory Group
SO	Shared Objective
TALIRI	Tanzania Livestock Research Institute
TFNC	Tanzania Food and Nutrition Centre
UDOM	University of Dodoma
USAID	United States Agency for International Development
WUR	Wageningen University and Research Centre
ZARI	Zambia Agriculture Research Institute
ZoI	Zones of Influence

Summary

The Africa RISING Program of the US Government's Feed the Future Initiative seeks to create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base. It designated three geographic areas of West Africa, Ethiopian Highlands and East and Southern Africa where interdisciplinary teams of agricultural scientists will work closely with development specialists, private sector and farmer organizations to conduct action- and impact-oriented research in pilot research and learning sites, designed to overcome the persistent constraints to agricultural production and enterprise development. In East and Southern Africa, the research and learning sites are situated in Tanzania, Malawi and Zambia, and they all constitute the East and Southern Africa (ESA) Project.

Some important features contributed to the selection of the research and learning sites of the ESA Project as a focus for agricultural and developmental research. The sites lie within the Zones of Influence (ZoI) for the Feed the Future portfolio, targeted because they have relatively high population densities and proportions of people reliant upon small-scale agriculture. But the sites have strong potential for agricultural growth if their resource base is stopped from rapidly degrading, largely due to mismanagement, through research, extension and peer support, all of which are quite weak. Within the ZoI, action sites were identified based on selected development domains, considered as the main drivers for intensification.

The 2012-2016 Africa RISING Framework identified the integrated Research for Development (R4D) paradigm as an opportunity to address persistent smallholder problems in new sustainable ways. R4D involves an integrated research agenda with a recognized need for innovation and flexibility among multidiscipline research partners. The research approach in the ESA Project is planned to develop integrated technologies with farmer participation but also empower them to better understand and respond to changing circumstances as they emerge. Over time, collaboration among research partners is to recognize the importance of interaction between commodity production, natural resource management, markets and policies, but also balanced with individual needs and goals (typology). Research Teams are formed to identify entry points for sustainable intensification in four research and learning sites, and engage different disciplines and stakeholders into an iterative integrated problem-solving R4D. The sites are Babati District in Tanzania, Kongwa and Kiteto Districts in Tanzania, Dedza and Ntcheu Districts in Malawi, and Chipata and Katete Districts in Zambia.

The Research Teams were commissioned during October 2012. The teams initially consisted of experienced agricultural scientists from mainly the CGIAR, NARS, national and international universities. Research managers, entrepreneurs, and marketing, policy, information and development specialists and farmers, interact with the scientists to prioritize, guide, scale and evaluate research and development progress through different stakeholder forums including the Annual Reporting and Planning meetings, and the R4D and Innovation Platforms.

The Annual Reporting and Planning Meetings are particularly critical as they provide the opportunity for stakeholders to contribute to the development of research plans that integrate

or streamline technology components along research to impact pathways. The current phase 1 of ESA projects targets, in the main, achieving informed technologies as outputs in a stepwise approach. These targets are summarized in a log frame showing that sustainable intensification innovations should be driven by three interdependent physical approaches: (i) those involving introduction of improved (and new high value) crops and livestock that increase resilience and productivity genetic intensification; (ii) those that integrate crop and livestock production in a manner that makes better use of sunlight, soil, water and biodiversity – ecological intensification, and (iii) those that increase availability of safe and nutritious food products for consumption and market.

Research Teams recognize that smallholder farmers are at the centre of the sustainable intensification (SI) process. The farmers' decisions to utilize SI technologies are guided by the overall benefits that will accrue from production. The technologies must not only be adapted to the biophysical factors that control yield and natural resource integrity, but also informed by the socioeconomic realities so as to be able to cause positive development. Therefore, specific research and development entry points are identified to guide the participatory development of integrated scientific technologies and/or the refinement of existing ones to provide new improved varieties and breeds, enhance nutrient and water recycling, improve disease and pest control, provide value addition and improved food safety, and expand enterprise development and diversification. Crosscutting issues that strengthen farmer and community networks and decision-making are purposefully addressed, e.g. through facilitated platforms, to make sustainable intensification feasible. Special attention is given to identifying innovations that address unforeseen emerging agricultural production challenges.

In this phase of the project, scaling is limited to "learning-by-doing" given that the developing and testing of the technologies is participatory, on the so-called "mother trials". Pilot-scaling of those technologies that are judged as positive outcomes (mature) by researchers and farmers, are performed on numerous small plots allowing more farmers (baby trials and/or coupon farmers) to "learn-by-doing" on their own farms. Through this approach, more farmers are empowered in a cost-effective manner. Relevant data will be collected to determine potential for adoption, adaptation and spillover effects, and to inform local development partners and input suppliers on the need to better access critical inputs and new crop varieties.

Africa RISING Program and the ESA Project

As part of the Feed the Future Initiative, the United States Agency for International Development (USAID) is supporting an innovative multi-stakeholder agricultural research program, the Africa Research in Sustainable Intensification for the Next Generation (Africa RISING). The program's main objective is to identify and validate scalable options for the sustainable intensification of key African cereal-based farming systems to increase food production and improve the livelihoods of smallholder farmer families and at the same time conserve or improve the natural resource base.

Africa RISING is a 5-year research program with three regional projects launched in 2011. It brings together a wide range of research and development partners from the CGIAR and the national agricultural research and extension systems, farmers, input and output dealers, and policymakers to develop management practices and technology combinations to better integrate crops (cereals, legumes and vegetables), livestock (including poultry), and trees and shrubs in mixed-farming systems with the aim of improving whole-farm productivity, nutrition, and incomes of small-farm families without degrading the environment. It will also develop innovations that effectively link farmers to markets and input suppliers.

The program is implemented through three regional projects as follows:

1. Sustainable intensification of crop-livestock mixed farming systems in the Guinea/Sudan Savanna Zone of West Africa – led by the International Institute of Tropical Agriculture (IITA),
2. Sustainable intensification of crop-livestock integrated farming systems in the Ethiopian highlands – led by the International Livestock Research Institute (ILRI), and
3. Sustainable intensification of cereal-legume-livestock integrated farming systems in East and Southern Africa – led by IITA, henceforth referred to as the ***ESA Project*****.**

The International Food Policy Research Institute (IFPRI) is responsible for monitoring, evaluation, and impact assessment across all three projects.

The program is organized around four research outputs (ROs) that are logically linked in time and space, namely: (1) Situation Analysis and Program-wide Synthesis, (2) Integrated Systems Improvement, (3) Scaling and Delivery of Integrated Innovation, and (4) Monitoring and evaluation. The first RO covers the activities necessary to ensure that research outputs are targeted effectively on development needs and are feasible for target farm households to implement. RO 2 is delivered via activities that will support the integration of SI-related innovations from a wide range of sources (past research, ongoing adaptive research and indigenous solutions) into the farming systems that are targeted so as to improve productivity, income, and natural resource management. RO 3 consists of the development of approaches for scaling-out systems innovations to similar development domains. RO 4 is a participatory monitoring and evaluation framework that will ensure that the outcomes related to the various outputs are clearly understood, that lessons learnt from one output are fed back into other outputs, and that the linkages between the various outputs are operationalized.

Africa RISING does not aim at promoting 'panacea' technologies or technologies that are best under all farming conditions. The program recognizes that priority constraints may differ in detail across regions and, therefore, guide the type of hypotheses to be tested and consequent research to be implemented in each region. This document, therefore, outlines the 5-year multi-disciplinary and multi-institutional research plan implemented by the Africa RISING project in East and Southern Africa.

ESA research and development constraints and opportunities

The general constraints and opportunities for smallholder crop and livestock production in the Africa RISING program areas are described in the program framework document. They are driven by a high population growth which is dominated by engagement in agriculture, high level of poverty and increasing food, fibre and feed needs (Table 1).

Table 1: ESA Project Country demographics

Country	Estimate Population - 2014 (millions)	Population growth rate (%)	Agriculture labour force (%)	Population below National poverty line (%)	GDP (per capita) - $	Maize (main staple) productivity (t/ha)
Tanzania	49	2.8	80	28.2 (2012)	1700	1.2-2.0
Malawi	17	3.3	90	50.7 (2010)	900	2.3
Zambia	15	2.9	85	60.5 (2010)	1800	1.0-1.8

* Values are estimates for 2014, except where years are shown in parentheses. Source: FAO and World Bank Statistics

At the October 1-5, 2012 Planning Meeting in Arusha, stakeholders identified key constraints to the smallholder farming practices in the ESA Project countries (Box 1). Emerging challenges, e.g. the maize lethal necrosis disease, were also considered important for Africa RISING. These have been confirmed and in some cases quantified in subsequent survey studies. Past research presents an array of technologies to address most of these challenges and an understanding of their causes; however they have been limited in scope of integrating components and knowledge at farming systems level. These observations have guided implementation of research activities in the varied agro-ecologies of the ESA Project. Broadly, the challenges and opportunities are described under the following categories:

Box 1. Key productivity challenges in the action sites in Malawi, Tanzania and Zambia (https://cgspace.cgiar.org/bitstream/handle/10568/24668/esaworkshop_report_oct2012.pdf?sequence=1)

- Availability of seed (tolerant to drought, pests and diseases, improved varieties, distribution systems)
- Low soil fertility
- Pests, diseases and weed management
- Poor agronomic practices (planting periods, spacing, crop mixtures, labour-saving technologies)
- Conservation of natural resources (integrated soil and water management)
- Post-harvesting technologies (value addition & utilization, food safety, agro-processing equipment)
- Markets (access, organizational, opportunities and niches)
- Institutions (farmer organizations, networks, innovation platforms
- Livestock (management skills, pastures and feeds, health, product processing, breeds)

Constraints and opportunities for producing more food – local/field scale

Limited adoption of improved crop varieties with physiological traits that reduce the yield gap, match the environment and offer diversity. One of the biophysical constraints to agricultural

productivity is the limited adoption of improved crop varieties that are high yielding and resilient to stress. At about the start of the project, CIMMYT (2010) estimated maize productivity under smallholder conditions in the Dodoma and Manyara regions of Tanzania as standing at 1.2 t ha^{-1}, well below the potential average of 4.5t ha^{-1}. Other major intercrops in the system were also yielding below potential at 0.6 t ha^{-1} (beans) and 0.5 t ha^{-1} (groundnuts). Similar low maize yield levels prevail in Malawi (1.3t ha^{-1}) and Zambia (2.5 t ha^{-1}). In part, this is attributable to the growing of traditional low yielding varieties. These are also grown in stressful agroecologies notably defined by low soil nutrients and moisture, heat stress, and crop disorders caused by pests and diseases.

Africa RISING scientists have the opportunity to introduce, test and deploy new crop varieties that are known to increase crop productivity, improve nutritive value, enable nitrogen fixation and enhance resilience to pests and diseases. This will be done in combination with field management aspects that reinforce tolerance, particularly those that enhance soil moisture conservation and availability to crops. For the emerging MLND (Maize Lethal Necrosis Disease), these aspects would be under validation since the solutions are not yet known.

Inherent and induced low soil fertility

The unintended impacts of smallholder-induced nutrient depletion express them-selves in form of continued declines in crop yields, which can be abrupt or gradual depending on soil type. Sub-Saharan Africa's soils are inherently nutrient impoverished; only 10 percent of the soils are geologically young and rich in nutrients[1]. The nutrient impoverished soils produce limited plant biomass; consequently, the soil organic matter content is low. Nutrient removal in crop harvests, with limited replenishment from external inputs, also contributes to nutrient depletion. In Babati (one of the characterized action districts in Tanzania), for example, the majority of the farmer fields had negative nutrient balances (at least74 % for N, 52 % for P and 66 % for K) indicating mining of the soil[2]. Limited application of nutrient replenishing inputs is evidenced by the low number (3%) of farmers applying fertilizers.

The weak demand for these inputs by small-scale farmers is not so much due to their limited capacity to invest in farm improvement but to the lack of knowhow and information on management options that would allow low, efficient and combined rates of application, which would lower external input costs and enhance the value of locally available inputs, notably the organic and biological (increased use of legumes) sources. Research Teams are therefore presented with opportunities to demonstrate the role of integrated soil fertility management (ISFM) in maintaining the soils' integrity for posterity at affordable costs. Approaches to nutrient restoration and use efficiency must be tailored to meet variations in soil properties and management conditions.

[1] Breman, H., et al. 2007. "The Lesson of Drente's 'Essen': Soil nutrient depletion in Sub-Saharan Africa and Management Strategies for Soil Replenishment." In A. Braimoh, and P. Vlek, eds. Land use and soil resources. Tokyo: Springer Media B.V., p 145-166.

[2] J. Kihara, L. D. Tamene, P. Massawe and M. Bekunda (2014) Agronomic survey to assess crop yield, controlling factorsand management implications: a case-study of Babati in northern Tanzania. *Nutr Cycl Agroecosyst.* DOI 10.1007/s10705-014-9648-3

Limited adoption of good agronomy practices (GAPs)
Agronomy is the science of managing growing crops and is, therefore, complementary to soil fertility management. Appropriate agronomic practices can make positive impact on soil fertility restoration provided they also result in positive returns to investment. Smallholder farmers in the three countries cultivate maize, as their main staple, usually spatially arranged in various combinations with other crops (especially legumes) as intercrops, relays or seasonal rotations.

Wisdom has it that these arrangements are designed to reduce risks as failure of one or more crops will be compensated by the others. The challenge is that this system, if not well planned, makes poor use of resources and results into excess intercrop competition. This provides an opportunity for scientists to introduce and fine-tune simple adjustments in the cropping arrangement of cereals and grain legumes, under smallholders' conditions within the context of on-farm, farmer-managed adaptive research so as to maximise the benefits of these crop arrangements. Other agronomic management practices of seedbed preparation, raising of healthy seedlings, early sowing, optimum planting densities, fertilizer placement and pest and weed control act to balance the plants' needs with available soil moisture, so water conservation practices and supplemental irrigation can be an important agronomic practice in drought prone areas.

Limited adoption of good livestock management practices
Livestock development was visioned as offering opportunities for improving food, nutritional and income security more in Tanzania where cattle rearing is predominant. Even here, however, only those systems that integrate livestock, mainly cattle and poultry, in the crop production systems are considered under the Africa RISING mandate. Although several challenges were identified (including availability of appropriate breeds for high productivity, and post-harvest handling of livestock products to allow better market access), the main one is how to ensure profitable production on the limited natural resource base. Thus the choice entry point is the provision of better quality and increased fodder and feed given that livestock have access to as low as 30% the required feed needs during the dry season, and are not fully fed even during the wet season.

The research opportunity is in demonstrating that establishment of high quality fodder species on underutilized land patches, like field boundaries and contour hedges, would allow increase both quality and availability of feed, improve feeding regimes when combined with chopped maize stover, but also contribute to the physical management of soil and soil-water resources. Livestock manure could be efficiently utilized in soil fertility management. These activities would maximize locally available resources for developing quality feed.

Constraints and opportunities for sustaining natural resources – farm and landscape scales
In many cases, continuous cropping of cereal-based systems has led to severe depletion of soil nutrients and organic matter, which in turn results in loss of ecosystem benefits, requiring research in land rehabilitation. The dominant annual cropping offers little protection to the erodible soils that become more exposed to the elements which cause erosion during the frequent tillage operations and post harvest open grazing systems during the dry season. All stakeholders at the 2012 Planning Workshop identified land degradation as a prevalent constraint to productivity.

Soil erosion control and water conservation technologies are necessary for keeping the nutrient capital in place, reducing soil and water loss and, therefore, contributing to the enhancement of production and the sustainability of the agricultural system. Africa RISING research has the opportunity to introduce and validate landscape based technological innovations as a component of integrated natural resource management. These include (a) biological methods of erosion control such as planting legume hedges or vegetative strips along contours with additional benefits of nitrogen fixation and provision of useful by-products like fodder and fuel wood, (b) maintaining live or stover ground cover, (c) strengthening conservation agriculture practices, (d) targeting *in-situ* water capture like with tied-ridging, and (e) introducing physical conservation structures which, however, tend to have high initial construction costs and require local institutional interventions. The goal is to develop watershed-farming enterprises that offer both food security and economic incentives to the farmers and consequently lead to the appreciation and adoption of long-term conservation measures as a means of protecting their enterprises.

Constraints and opportunities for reducing food loss and spoilage

According to the World Resources Institute, approximately 23% of available food in Sub-Saharan Africa is lost or wasted (WRI 2013[3]). This equates to the loss of 545 kilocalories per person, per day across a sub-continent where 24.8% of the population is undernourished according to the Food and Agriculture Organization of the United Nations (FAO 2013[4]). It can also equate to increases that new production technologies bring about when introduced in same societies. Mycotoxins contamination is, in part, caused and/or increased by poor produce handling and storage practices. Yet many simple tools and approaches for reducing post harvest loss and spoilage exist; however, uptake and adoption by smallholder farmers remain limited in part due to lack of awareness of these alternatives and skills to use them. The ESA Project has the opportunity to demonstrate and promote access to effective technologies that reduce product spillage and degradation during handling and storage, and allow farmers to hold their crops for extended periods of time, also contributing to better returns from sales during periods of low availability.

Constraints and opportunities for technology delivery and scaling

The challenges identified as information, communication and capacity building (Box 1) translate into a host of several economic, social and institutional constraints. Specific opportunities available to the ESA Project Teams include (but are not limited to):

i. Generation and compilation of knowledge of improved and affordable technologies for sustainable agricultural production
ii. Building capacity of farmers and information providers (local extension agents and development NGOs) in the use and scaling of the technologies
iii. Facilitating formation of institutions (e.g. R4D and Innovation platforms) for guiding and advocating for smallholder improved farming.

[3] Lipinski, B. C. Hanson. J. Lomax. L. Kitinoja. R. Waite. T. Searchinger. 2013. Reducing Food Loss and Waste. Washington, DC: World Resources Institute. Retrieved from: http://www.unep.org/pdf/WRI-UNEP_Reducing_Food_Loss_and_Waste.pdf

[4] Food and Agriculture Organization. Food security indicators. 2011-2013. Retrieved from: http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.U3OF8ygSdqI

Opportunities for integration of technologies

In describing the categories of challenges above, threads of inter-dependency of technology development opportunities to increase their use efficiency already become apparent. So, while the identified challenges may act as critical research entry points, it is clear that the nature of interactions between potential solutions determines the overall productivity response. This is emphasized in the integration hypothesis of the Program's Framework thus "Innovations with components that mutually reinforce whole farm performance produce more sustained benefits than single components". During the first year of Africa RISING, one of the targeted outputs was partnership building, i.e. bringing together different disciplines/institutions to design research trials that would address this hypothesis.

ESA Project objectives and outcomes

The ESA Project subscribes to the Africa RISING Program purpose, "*…to provide pathways out of hunger and poverty for smallholder families through sustainably intensified farming systems that sufficiently improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base"*. Although in line with the program objectives, the current ESA project phase objectives are time-bound; i.e. defined in terms of what, of the program purpose, can be realistically achieved during the current phase, and specificity to the ESA Region environments. ESA Project Teams are conducting research on the technologies for sustainable intensification of agricultural production systems (addressing more of "Research Objectives" in the Program Framework, than "Development Objectives" – Box 2). So, the overall current phase ESA Project objective is to ***develop integrated technologies through an approach of stepwise iteration that (if adopted) will improve smallholder-farming systems in the ESA region as a means of enhancing food, nutritional and income security among the smallholders***.

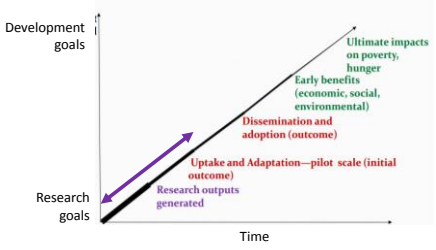
Specific objectives (SO) that follow, although stated in specific terms, are components in a performance model P=G*E*M*L*M (Genotype by Environment by Management by Landscape by Markets) used as a framework to locate research within the context of drivers of change in farming systems. The specific ESA Project shared objectives are:

SO 1: Quantify the scale and magnitude of the above-identified and other ESA Region productivity challenges for understanding major constraints to improved livelihoods and identifying opportunities for targeting sustainable integrated innovations.

SO 2: Identify and evaluate appropriate single or combined technologies and interventions in a manner that complements on-going farm enterprises to increase productivity and enable adaptation to changing production conditions (e.g. those brought about by climate change).

SO 3: Identify and evaluate technologies that contribute to sustainable agricultural resource management, including protection of land and water resources and fostering agricultural biodiversity.

SO 4: Deploy and validate modeling and decision support tools to fast-track identification and impact of scaling options.



Box 2. Research to impact pathway.

The ESA Project current phase Sphere of action along the pathway is highlighted by the two way arrow (also see Appendix x – Theory of Change diagram). Activities include site selection, partnership building, baseline and characterization, design of research trials implementation, research refinement & expansion, and transfer of research outputs for adaptation.

SO 5: Deploy and evaluate technologies that reduce product losses and offer nutritional and marketing advantages.

SO 6: Facilitate and expand membership of community platforms to enable them realize opportunities and services available to them as agricultural producers, marketers and resource managers.

S0 7: Make recommendations and construct protocols for the generic deployment of the SI technologies so that comparability of their delivery and scaling is attained and general functional principles are clearly understood.

Meeting these objectives will contribute to program-level research outputs 1 and 2, and program-level development outcome 1.

Conceptual framework

Figure 1 provides a framework that will guide the stepwise research on and development of integrated technologies and innovations that will reduce post-harvest losses and spoilage, improve crop and livestock production systems and minimize loss of environmental quality, each of which contribute to the food security and improved livelihoods of rural smallholder farming households.

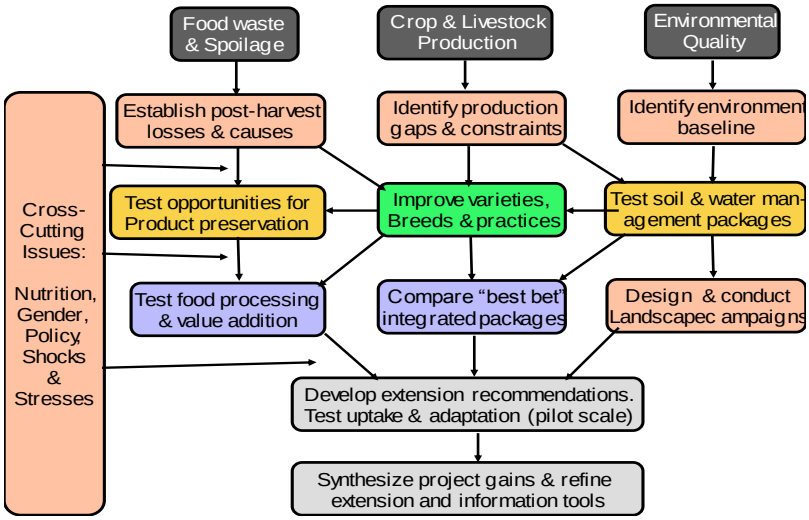


Figure 1: Conceptual framework. The project activities align along intersecting research pathways culminating in the integrated formulation of informed extension advice to extensionists and smallholders. Information is generated, and technologies are tested at different scales of operations; landscape or community level (orange), plot/field levels (green), farm (yellow) and farm and/or community (purple). Impact of any technology can only be felt if its adoption is additive to landscape level and beyond.

Conditions for post-harvest losses, spoilage and causative factors; crop and livestock production gaps and constraints; and environmental integrity are determined by baseline surveys and farming systems analyses, supplemented by discipline-specific surveys, using internationally tested tools and locally developed questionnaires. The established baselines are used for identifying research and development entry points, as well as for monitoring change resulting from the participatory research activities. A suite of practical indicators based upon landscape, physical, chemical, biological, economic and land management criteria applicable to small-scale farms are used to monitor change and also as a means of validating the technologies.

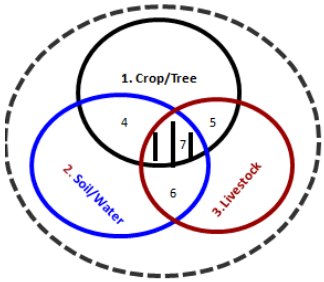
Baseline conditions are characterized in Years 1 and 2, and opportunities for improvement identified. These opportunities, consisting of candidate post-harvest product handling, crop, livestock and land management practices, are tested through participatory research approaches in Year 2 and 3, and integrated management packages developed and tested for adoption/adaptation through household and on-farm evaluation in Years 3 and 4. Each step of the interdisciplinary framework is strengthened by previous activities. Year 5 is largely devoted to refining, describing and recommending "mature" SI technologies, developing information and

extension material to enable their large scale dissemination, and synthesizing project gains. Cross-cutting concerns, while not core performance indicators, will be tracked to ensure enhanced technology targeting, delivery and equitable access.

The design of the research activities will result in extension recommendations that will be holistic, with better food product handling, increased crop and livestock production, and more effective land management, and depicting how configured farm systems should look like on implementing the recommendations. The research to achieve these will be guided by the following hypotheses.

ESA Project Hypotheses

There are 5 program-wide hypotheses against which projects were expected to formulate own hypotheses at the next level of detail with demonstrable contribution to the testing of at least one program hypothesis. During the ESA Project Planning meeting of 2012, it was considered that the Africa RISING physical operational niches should lie within the intercepting zones of crop/tree, soil/water and livestock research (Box 3 – and mainly relating to the components of improving food production systems and minimizing loss of environmental quality described in Box 2), but keeping in mind that genetic intensification is primary to the more management oriented integrated processes. To a large extent, the hypothesis formulation exercise is built upon integrated disciplinary interests; more discipline-specific questions are developed within annual thematic (Research Team) proposals. The ESA Project shared hypotheses are as follows:



Box 3. Integrated research as the operational niche for Africa RISING. It was considered that research activities should aim more at integrating ecological processes (ecological intensification - within interception zones 4, 5, 6 and 7) in agroecosystems. Concurrent socio-economic studies would identify which of the efficient technologies identified would be most effective.

H1. Innovative baseline information gathering, organization and sharing systems will enhance development, targeting and uptake of SI technologies. Related research questions:

1. *What are the required forms of information (e.g. biophysical, socio-economic) that guide development of SI technologies and new products?*
2. *What knowledge gaps are missed by IK and can be targeted to enhance targeting of innovations?*
3. *What are the features of household typologies that present opportunities for targeting and adoption of SI technologies?*

H2. Productivity of crop and livestock enterprises can be improved through a combined adaptive and iterative technology development process applied to new problems.
Related research questions:

1. *Which new farm enterprises (single or combined options) permit smallholders to improve their livelihood without depleting natural resources?*
2. *Which accompanying production and resource conservation technologies complement adoption of the new enterprises or improvement of existing ones?*
3. *Which economic incentives render these technologies attractive to beneficiaries?*
4. *What is the role of women and youth within the new and/or expanded enterprises*
5. *Do more diverse farm enterprises enhance farm productivity and biodiversity?*

6. *How do opportunities for reducing losses and retaining quality of stored products improve food security and income generation?*
7. *What food processing and utilization technology options are available to improve human nutrition and stimulate increased use SI options*?

H3. Investment in partnership arrangements (platforms) that integrate research and development expertise assists partners to better understand and scale successful technologies. Related research questions:

1. *How can R4D and innovation platforms link a range of organizational actors to promote the simultaneous technological, social and institutional change needed for sustainable intensification?*
2. *Which is the most relevant level of operation of these platforms to promote sustainable intensification (village, landscape/catchment, district, etc)? How can a platform be designed to link to the next level?*
3. *Platforms are characterized by priority setting, networking and negotiation, involving program stakeholders and intended beneficiaries. How can research support in establishing a consistent methodology for creating an inclusive environment, allowing collaboration in trying and evaluating different alternatives and their potential for scaling?*

H4. More responsive and interactive information sharing is required to facilitate awareness and adoption of useful SI technologies but this information requires processing before it is useful at different decision making levels. Related research questions:

1. *What forms of information that accompany SI technologies and new products are required and how are they best distributed?*
2. *How can SI technologies be better presented to make them more understandable to agricultural specialists engaged in routine problem solving?*

ESA Project research outputs and expected outcomes

Outputs
The ESA Project research outputs are given in the appended logframe, whose building blocks are deliverables identified in the annual Research Team thematic proposals. The major research outputs will include technology packages that integrate food production and natural resource integrity, publications and research-related trainees at farmer, extension and graduate levels. Extension material and rural development strategies will be developed, and these will stimulate technology and information dissemination activities that are designed to accelerate adoption of the SI technologies that promote sustainable land management, increase diversification of crop production, increase activities related to minimizing product losses, and improve livestock feeding.

Expected outcomes
The overall outcome of the current project phase is the adoption of technology packages and field practices that lead to sustainable, integrated cropping systems for improved food security and environmental health. Better designed extension material and rural development strategies will stimulate technology and information dissemination to enable the following:

1. Improved access by smallholder farmers to new crop varieties that are proven to be drought tolerant, disease resistant and pest tolerant, and also contribute to better nutrition.
2. Better managed land through accelerated adoption of developed SI technologies that promote sustainable management. (New options for sustainable water and land productivity in water scarce semi-arid areas will be adopted. Farmers will practice field operations in the context of ISFM that make best use of available organic resources, judiciously applied mineral fertilizers, biological nitrogen fixation and soil erosion control).
3. Increased investment in the production of more and higher quality feeds and fodders to support livestock production.
4. Increased food availability through enhanced skills for agricultural product handling and storage.
5. Improved household nutrition through integration and consequent consumption of highly nutritious vegetables and quality protein maize within the farming systems.
6. Overall farming system productivity is improved by exposing to farmers innovations that address sustainable intensification.
7. Strengthened R4D and innovation platforms will offer a wide range of services that generate incentives to adopt SI technologies, but will also actively participate in food security development initiatives.
8. Strengthened research and outreach capacities of local universities, research, development and private sector institutions through mentoring of graduate students attached to ESA Projects. These graduates will enter the rural research and development work force with strong interdisciplinary and problem solving perspectives.
9. An interdisciplinary book on smallholder crop and livestock production and enterprise in the ESA Region that is intended as a desktop reference and instructional resource will be

published and distributed. This and other developed communication tools will generate interest in SI activities and attract extra investments.

10. Continued active partnership cooperation between research, development, private sector and other relevant institutions in sharing lessons and experiences thereby leading to disciplinary integration and scaling up of the most effective food security messages in ESA and beyond.

Project implementation

Action sites

Selection of Project Sites in Africa RISING involved the necessity to ensure that, within the Programme Sites, Project Sites cover as much as possible of the spectrum of biophysical and socio-economic variation within the Programme Site so as to facilitate extrapolation of the interventions' effects to large areas of sub-Saharan Africa, with similar conditions and characteristics. This process involved iterative interaction between field research teams and GIS experts from the IFPRI M&E team, resulting in a final selection of Project Sites that met the required criteria. Based on analysis of all available biophysical, crop production and socio-economic data, a minimum set of Project Sites was set up to ensure that all major variation was covered. The list was then submitted to the field research teams for them to assess where work is feasible based on local technical and logistic resources, constrained by project funding.

The starting point for spatial analysis is the definition of the Programme Site (Mega-Site) proposed by USAID and accepted by the project coordinators of each Africa RISING regional project. This was in the form of a farming system within a specific geographic area, for example “Maize-Legume-Livestock systems in Dodoma and Manyara Regions of Tanzania”. The first step for the IFPRI team was to identify sub-units within the geographic area matching the required farming system, using available crop and livestock data. The second step was to eliminate those districts with either very low population densities or very poor access to markets, since the success of this project depends on impact on large populations and the development of market-based farming. Within the remaining administrative units, usually districts, an analysis was carried out across variations in elevation (proxy for temperature), rainfall, population density and topography, each parameter being classified into three or four groups, based on high-resolution spatial data at grid-cell level (of various sizes). Each district was then classified on the basis of these groups to identify the main clusters (or areas of homogeneous agricultural potential) within the Programme Site, and these clusters then formed the basis for final site selection (Figure 2).

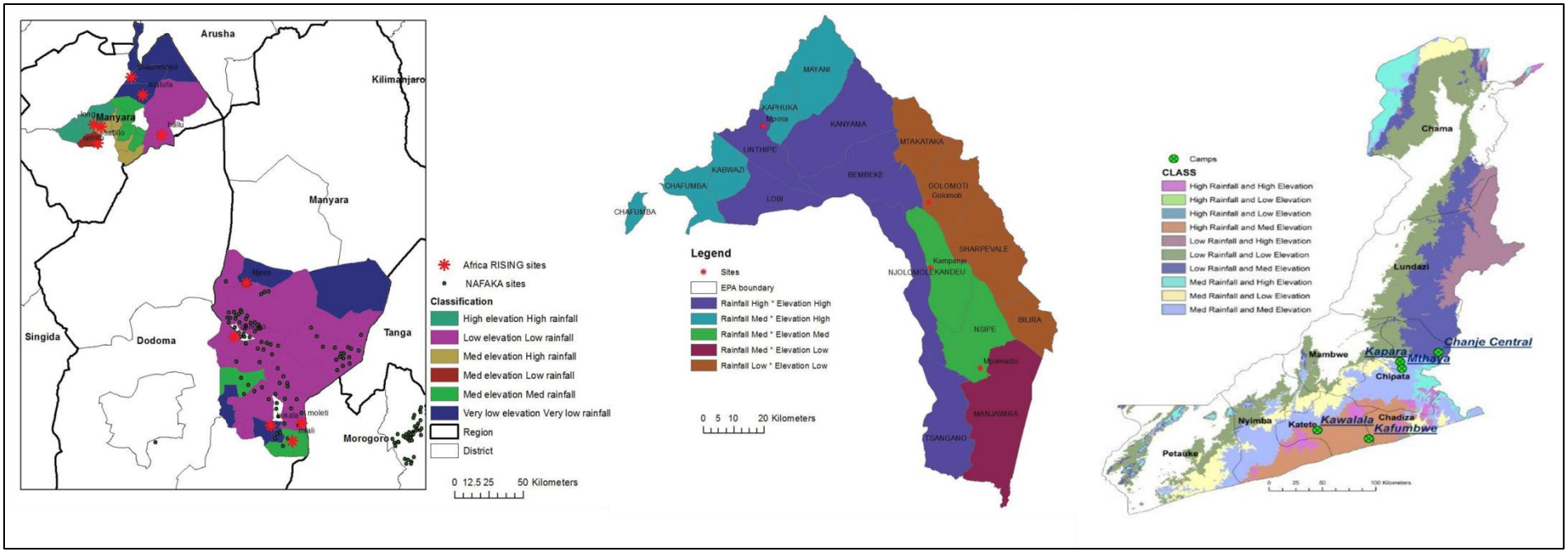


Figure 2: There are three districts in Tanzania (Map to the left) - Babati and Kiteto in Manyara Region of northern Tanzania as well as Kongwa District in Dodoma Region, and the action sites are defined by **villages**. In Malawi (centre map), the project activities are implemented in Ntcheu and Dedza Districts in central Malawi, and the action sites are defined by **sections**. Activities in Zambia (map to the right) are implemented in Katete and Chipata Districts in the Eastern Province and Lusaka District, and the action sites are defined by **camps**. The villages, sections and camps locate in different spectra of biophysical and socio-economic variation.

Stakeholder participation

All stages of this research are conducted in close cooperation with all relevant stakeholders to create buy-in, ownership of processes and results, and as a way of ensuring impact beyond the project life. We work with farmers and farmer organizations, addressing capacity building issues necessary for accessing effective and equitable services. Lead Farmers are drawn from participating farmers' groups and associations and trained to assist their respective members in better crop and livestock production and resource management. These farmers host field demonstrations and recruit neighbours to undertake second-stage technology testing, based upon a mother-daughter approach, with the most promising few technologies most attractive to farmers identified within larger Lead Farmer technology trials and replicated on their own fields. Gender disaggregated data on farmers' choices and impressions are collected and analyzed during the following season to determine indicators of technology potential.

Researchers appreciate the challenge of designing research to generate technologies that address SI given that productivity increases will come from a combination of multi-discipline efforts addressing contrasting regional, bio-physical, economic and societal circumstances. In the case of ESA, four Research Teams are located in defined action sites (Babati, Kongwa& Kiteto, Malawi and Zambia - Figure 2), and within each Team, research themes are identified and used as a base around which interdisciplinary research is designed. The research implementation is then interactive on, where possible, given action sites, as is also the number of researchers from different institutions. Where research activities are not conducted/integrated on same fields, and especially those that are covered in overlapping periods, separate calculations and modeling will be used to add them together. Cost-benefit analyses are performed to establish the effectiveness of the technologies. Cooperation with NGOs and local extension services with extensive experience in the communities will ensure that the project activities continue to contribute to environmentally sustainable food production through continued promotion by the organizations.

The actual research and dissemination planning for the Research Teams is done during the annual project-level Review and Planning Workshops during which stakeholders receive progress reports and give direction and guidance on Team project designs for the successive year. Allocation of resources and budgeting are done during the planning. The stakeholders are identified representatives from research, public, private and donor institutions as well as farmer representatives and the Project Steering Committee. Research Teams also conduct feed-back and planning meetings with farmers, farmer groups and R4D or Innovation Platforms at action site level, usually when preparing for the next cropping season. Local farmers assist in site selection and on-farm work and strong working relations with local administrators and extension supervisors ensures continuity and lobby in favor of local policies that support small-scale farmers, especially on landscape level activities.

Description of Research at action sites

One of the guiding principles for the Africa RISING Program is the Stepwise progress towards sustainable intensification. It was commended that the logic of the principles underlying Integrated Soil Fertility Management (ISFM) - a stepwise approach to move towards sustainable systems - could apply to other innovations investigated by Africa RISING, irrespective of site specificity. Research Team activities are, therefore, stepwise and flexible in implementation, based on the principle of "learning as you go" (see Figure 1). This allows an activity to build on what is working drop what is not, and take advantage of unforeseen opportunities as they arise. Because of this approach, research activities and the implementing institutions are described in annual Research Team proposals that are developed during the Report and Planning meetings.

The four Research Teams in ESA are defined by the action sites as follows: the Babati Research Team (Tanzania) with IITA as lead institution and Mateete Bekunda as PI; the Kongwa & Kiteto Research Team (Tanzania) with ICRISAT as lead institution and Patrick Okori as PI; the Malawi Research Team with Michigan State University as lead institution and Sieglinde Snapp as PI; and the Zambia Research Team with CIMMYT as lead institution and Peter Setimela as PI. Between the Research Teams, the topics that have been addressed separately or interactively, on individual or cross-sites and the institutions involved, are given in Table 2.

Table 2: Summary of technology-development activity descriptions and associated implementing institutions across the 4 sites of the ESA Project

Theme	**Activity description**	**Core Research Institutions**
Genetic intensification	Introducing new varieties increase crop productivity, improve nutritive value, enable nitrogen uptake and fixation and enhance resilience to pests, diseases and negative environmental elements.	ICRISAT, CIMMYT, Naliendere ARI
Integrated soil fertility management	Better management of nutrients from fertilisers and manures to improve crop use efficiency	CIAT, IITA, Selian ARI, Hombolo ARI, MSU, ICRAF, LUANAR
	Evaluating potential of grain/legume inter-cropping, relay-cropping and doubled up legumes for increased crop and land productivity within the improved germplasm.	
	Validation of *in-situ* water harvesting and retention techniques for erosion control and improved water use efficiency.	
Improved livestock feeds	Screen and integrate forages in systems and improved use of crop residues.	ILRI, UDOM, Tanzania Pasture Research Institute, ICRAF, TALIRI, LUANAR
	Improve storage, processing and utilization of crop residues for ruminant feed.	
	Test improved sylvo- pasture systems with adapted browse species to support the agro-pastoral communities.	
	Improve poultry genetics and feeding for enhanced productivity and nutrition.	
Vegetable integration for	Introduce and evaluate improved varieties of vegetables or vegetable species in cereal-based	AVRDC IITA

enhancing nutrition	farming systems.	
	Validate and disseminate best-bet management packages around the most promising farmer selected new crop varieties	
	Validated postharvest processing and utilization practices for enhancing produce shelf-life and marketing	
Produce storage, value addition and mycotoxin management	Evaluate labour and time saving use of mechanical processing equipment for farm operations like shelling and drying.	IITA, NMAIST, UDOM, TFNC, COUNSENUTH, ICRISAT, LUANAR, ZARI
	Identify and test postharvest management techniques that improve product safety, increase the income and nutritional status of the communities.	
	Deploy and test control interventions to mitigate mycotoxin contamination.	
	Provide and evaluate processing and nutritional value addition technologies for legume and dairy products, capturing a wide range of recipes.	
Land management efficiency	Application of physical and biological barriers for erosion control and water trapping at landscape scale.	CIAT, Hombolo ARI, ICRAF, CIMMYT
	Conduct landscape level assessment of associated ecosystem responses on impacts of erosion and land degradation on water quality, soil carbon storage and nutrient retention under different crop and crop-forage systems	
	On-farm validation of conservation agriculture technologies that increase productivity and incomes from maize-legume system	
Cross-cutting	Economic evaluation of technologies	IITA, WUR, & IFPRI in partnership with all researchers
	Farming Systems analysis	
	Monitoring & Evaluation	
	Gender analysis	
Capacity building	Mentoring student research (see Appendix 2)	All Institutions
	Short-term farmer and development partner training	
	Facilitating R4D & Innovation platforms	

Communication and dissemination

The main outputs from this project will be technologies and publications that will contribute to improved smallholder farming systems, product preservation and household nutrition. The publications will be in various forms such that the different categories of stakeholders are engaged and targeted. These include extension manuals, a reference book, journal articles, policy briefs, audio-visual documentaries, flyers and information brochures. Farmers' participation in planning, implementation and evaluation of trials will help create an early demand for successful and suitable information packages. Community mobilization and training through partnership with development NGOs and grassroots organizations will ensure that all community members benefit from the technologies and opportunities offered by the project. The training will be complemented by field days where community members in the project areas, other farmers and other stakeholders from the region will be invited to observe best practices and lesson learnt.

In addition to field days, stakeholders in the project areas will be invited to general platform meetings. Both, the field days and platform meetings, will be useful forums for showcasing the project outputs with potential for adoption, adaptation and up scaling within the maize-based systems of ESA. The different forms of technologies (prototypes) ready at the time will be availed to participants during the field days in lottery[5] form to judge farmer decision making on the technology, its adaptation and potential impact. Cross-site visits are proposed as an opportunity for participants to visit, learn and share experiences at 'Action Sites' in the host countries.

Dissemination of project results and lessons learned will also occur through peer-reviewed journal articles, presentations at scientific / professional meetings, through electronic and print media, and presentations to country-specific policy stakeholders. The project will also prepare a book to further disseminate the results of the project.

[5] The lottery is made of two sets of coupons; one set gets the winners a kit with components (inputs) for the selected technology to enable the farmers implement on a given area of their farms. It is assumed that the farmers mastered implementation procedures from the mother trial, but with freedom to adapt/modify implementation. The other set of coupons is blank. This set of farmers is followed up to determine their ability to go-it-alone after identifying with the success of the technology.

Monitoring and Evaluation

IFPRI has the overall responsibility for M&E, a critical component of the project for several reasons. It will support effective project management, provide data for timely reporting to project funders, and help all stakeholders to learn about the project's successes and failures. A robust M&E system will also provide learning opportunities on what did and did not work that, in turn, should inform the design and implementation of new interventions, as well as catalyze adjustments to ongoing activities that might enhance efficiency and effectiveness.

While highly complementary, monitoring and evaluation activities are separate both in their purpose and their implementation. Monitoring Africa RISING Feed the Future indicators conforms to the overarching M&E standards, best practices, and core indicators established for the entire FTF initiative. The Africa RISING M&E team has developed an open-access, M&E data management and analysis platform to serve the needs of research scientist and other stakeholders, the Project Mapping and Monitoring Tool (PMMT). The PMMT is ultimately intended to help users understand where and how Africa RISING activities are taking place, and improve project strategies and partnerships for greater impact in their work. Its features and functions have been designed to provide the following benefits:

a) inform strategic and project management decisions;
b) communicate programmatic projects to key stakeholders; and
c) understand how programmatic efforts relate to other projects as well as to useful agricultural information.

Three local training sessions on the use of the PMMT were organized in all the action countries.

Beyond its formal monitoring obligations, the Africa RISING M&E team is generating data and information on a range of farming system and livelihood outcome indicators to provide enhanced research management and outcome mapping needs. To inform planning and long-term projections of potential innovation impact at scales beyond the actual action research sites, forward-looking analysis will explore the productivity and sustainability consequences of a range of adoption scenarios and geographic/system spillover pathways across broader landscapes in East and Southern Africa.

Programs like Africa RISING provide great opportunities to learn about what works and what does not, along with the 'why' and 'how' of it. Information collected as part of the program can support various types of evaluation, especially if assessment designs are carefully considered at the onset of the program. To this end, baseline data collected from the three countries will enable assessment of the East and Southern Africa project's impact on a range of socio-economic and agricultural indicators, both at the household and community level.

A properly and scientifically designed impact evaluation is also necessary for well-informed decisions about scaling up. Unlike project monitoring, which examines and tracks whether targets have been achieved, impact assessment examines how outcomes of Africa RISING beneficiaries have changed as a direct (and, if modelled explicitly, indirect) effect of the program. It seeks to provide cause-and-effect evidence and quantifies changes in development outcomes that are *directly* or *indirectly attributable* to Africa RISING, and not to other

confounding factors. In order to provide with credible evidence about Program attribution, the M&E team devised a quasi-experimental evaluation design, of which main steps are below:

1. Stratification of geographic areas and creation of development domains based on agro-ecological potential.
2. Selection of action sites from the delineated development domains, in collaboration with research teams on the ground.
3. Identification of control sites located in the same development domain as selected action communities.
4. Household listing to compile the list of all agricultural households in action and control communities.
5. Random sampling of households in control sites (control households), as they will serve as a valid counterfactual to program beneficiary households.
6. Purging of beneficiary households from the household list for action communities discussed under (4)
7. Random sampling of non-beneficiary households in action communities. Data from non-beneficiary households. They are used to examine potential spill over effects.[6]
8. Gathering baseline and follow-up data from program beneficiaries, control households, and non-beneficiary households using structured questionnaires.
9. Using baseline and follow-up data, compare various socio-economic and environmental outcomes of interest among beneficiaries, non-beneficiaries, and control households through non-experimental methods, such as regression analysis (e.g., matching).

[6] Spillovers refer to a situation where farmers not eligible to receive AR intervention, or who are eligible to receive the intervention but have not received it, benefit from the intervention indirectly through a variety of ways – such as externalities (e.g., when channeled by successful AR farmers), general equilibrium effects (e.g., depressed maize price through increased maize production due to AR interventions), social and economic interactions (e.g., neighbors and relatives interacting with and learning from a successful AR farmer), and behavioral changes.

Data management

Within Africa RISING program, data are being produced at various points in project implementation and evaluation. During the testing of interventions for sustainable intensification, various types of experimental data will be collected (Table 2), such as improved seed varieties, fertilizers, management practices, biomass, soil coverage, water retention, water use efficiency and their combinations thereof. In addition, observational data will be collected about local farming systems and farmers who rely on them. Additionally, information on plant specimens and demonstration plots are likely to be available. Prior to the dissemination of technologies and eventual distribution of inputs, socio-economic baseline data have been collected from farmers. These observational data will be used to better tailor the design of research activities. As interventions are taking place, research teams will collect additional observational data on various forms of inputs distributed (such as combination of technologies and packages, training), and on the recipient farmers.

Table 2: Data Types available in the Africa RISING Program

Data Type	***Description***
Observational	Survey data (quantitative, qualitative) or information captured from sensors
Experimental	Information collected in a laboratory or other controlled settings (such as trial, control, or farmer-managed plots)
Simulated	Information projected using computers or other modelling mechanism
Derived/compiled/analyzed	Secondary information collected and/or contextualized; maps, graphs, and other data visualizations; software or web tools
Physical	Specimens collected or created in the field
Metadata	Descriptions of data, including but not limited to the source, methods, and tools used to collect data

Africa RISING has made a significant commitment to deliver, maintain (and enhance where appropriate) an open-access data management platform, in line with the USAID and CGIAR respective policies. Following these policies, the Africa RISING M&E team has developed a data and knowledge management platform to leverage data assets and tools produced and maintained by project partners (e.g., ILRI ImpactLite and SLATE, HarvestChoice's 600+ SSA data layers www.harvestchoice.org). The platform will serve four key purposes:

1. Provide implementation partners with a secure, web-based data storage and documentation repository that over time constitutes a major Africa RISING knowledge pool supporting further discovery, integration and analysis;
2. Provide a set of procedures to capture, validate, and integrate indicators, which can generate periodic monitoring reports on indicators agreed with Africa RISING partners (USAID, CGIAR CRPs and Centers, and other national and transnational partners)[7];

[7] Wherever possible Africa RISING data will be gathered dynamically from partner-curated data holdings accessed through metadata query and harvesting tools and APIs. Data coding/metadata standards will be adopted/developed…

3. Provide a live repository for non-indicator variables that are used to provide baselines, context and input variables to inform systems modeling and evaluations of interventions intended to support farming systems, post-harvest activities, and market-related activities;

Serve as a one-stop, structured and searchable inventory of Africa RISING project and partner organizations, activities, and outputs catalogued in a consistent manner across the entire Africa RISING portfolio, thereby enabling investment and institutional data to be linked to a range of data layers. The platform will include both tabular (e.g., plot, household and community) as well as spatial data and will support management of indicators and other variables as time series (in regular or irregular time series formats).

In addition to data, researchers in Africa RISING produce data collection tools. These tools may include questionnaires, focus group guidelines, or other templates and technical manuals used to organize and collect the data. All Africa RISING researchers must share data collection tools and supporting documentation to facilitate understanding of the data, and further enhance collaboration among partner institutions. To this end, and to keep track of all tools and data collection efforts, it is necessary to keep a repository and compendium of tools in Africa RISING.

All tools and data will be collected in the ILRI-CKAN web-based repository, accessible by researchers through a prominent link in the Project Mapping and Monitoring Tool (PMMT) website, accessible here: http://dev.harvestchoice.org/africarising/. This compendium of tools used by each research team should be updated regularly and uploaded onto the ILRI-CKAN system. For detailed information on data management protocols, rules, requirements, ownership, diffusion, and security of Africa RISING data and tools the Data Management Plan can be found at the bottom of this webpage: http://africa-rising.wikispaces.com/program_moneval.

and supported by the M&E data and knowledge management support team over the life of the Africa RISING initiative.

Project management and coordination

The project is part of the management and coordination structure of the entire Africa RISING program which has two basic levels: the three regional projects and the entities for program coordination, communication, monitoring and evaluation, and scientific advice (Figure 3). Each regional project has its own Steering Committee. The Terms of Reference of the East/Southern African Steering Committee are as follows:

- Provision of advice and oversight on project activities:
    - ✓ Scientific guidance to the project implementers to ensure conformity with the Program Research Framework and objectives
    - ✓ Guidance on project planning and activities
    - ✓ Approval of the annual work plan and budget
    - ✓ Oversight of coordination among project components and partners
- Liaison with program M&E Team to oversee M&E
- Information of Program Coordination Team via Project Coordinator
- Review of and suggestions to the Project Coordinator on the semi-annual technical progress reports to USAID
- Planning of yearly stakeholder meetings

The Project Coordinator is the contact point for the donor on all project matters and the official representative of the project on behalf of the implementing institution, IITA. S/he provides leadership and the long-term project vision. S/he is ultimately responsible for the implementation of the project by all participating partners. S/he is in charge of partners' contracts and monitors partners' reporting and compliance with agreements. The Project Coordinator acts as Secretary of the Steering Committee, and is a member of the Program Coordination team. S/he oversees the implementation of the project in the three countries, reviews work-plans before approval by the Steering Committee to ensure alignment with the program frame work, assigns budgets for country-level research, and coordinates the strategic direction with the other two regional projects in West Africa and Ethiopia. S/he is the link to the M&E team at IFPRI and the Program Communication Group at ILRI. S/he is also responsible for the financial management of the project. Technical and financial reporting to the donor, Steering Committee, PCT, Science Advisory Group (SAG), and Humidtropics CRP are part of her/his duties. Together with the Chief Scientist s/he identifies national and international staff needs and coordinates international recruitments. S/he facilitates communication among project partners and acts as mediator in conflict situations. All internationally recruited IITA project staff are co-supervised and guided by the Project Coordinator.

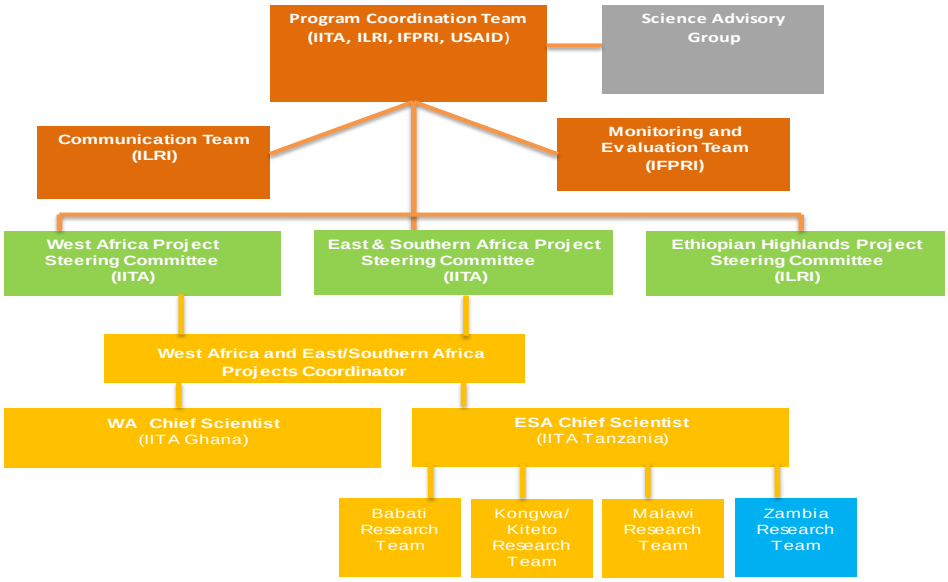


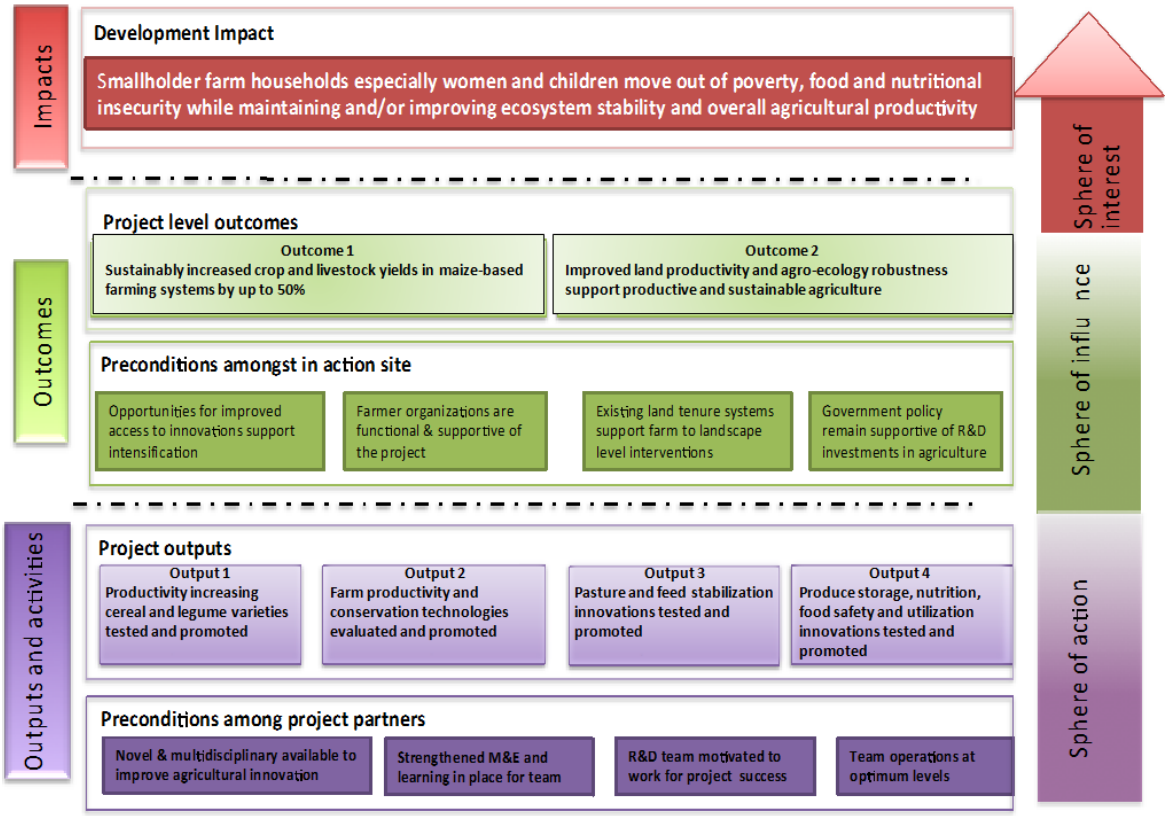
Figure 3: Africa RISING program and project management structure

The Chief Scientist is responsible for the planning and implementation of research in Babati and also oversees research in Kongwa/Kiteto, Malawi and Zambia, and advises the Research Coordinators at these sites. S/he leads the development of the work plans of all research partners in Babati. S/he assists the other research teams in Kongwa/Kiteto and in Malawi and Zambia to develop their research plans to ensure compliance with program strategy and cross-country alignment. Together with the Project Coordinator, the Chief Scientist revises the work plans before submission to the Steering Committee. During implementation, s/he monitors progress and assists partners in problem solving. S/he supervises all IITA national project staff in Tanzania and national staff working on behalf of international institutions not present in the country. Project Coordinator and Chief Scientist agree on fund allocation to the research teams who then divide the amount among themselves according to the costs of proposed and agreed activities.

The Chief Scientist is the first contact point for the USAID mission and related research and development projects in Tanzania. S/he manages the project office in Arusha.

Appendices

Appendix 1: ESA Project Theory of Change



*Adopted from the Kongwa & Kiteto Research Team Proposal for 2014/16

Appendix 2: Undergraduate and graduate students who have been or are still under mentorship by research partners, and conducting research on Africa RISING ESA Project action sites

Student	Sex	Country of Origin	Country of Research	Africa RISING supervisor	University	Degree MSc/PhD	Period
Semeni Ngozi (iAGRI)	F	Tanzania	Tanzania	Per Hillbur	Egerton Univ, Kenya	MSc	May 14 – May 15
Marco Sanka (iAGRI)	M	Tanzania	Tanzania	Per Hillbur	Makerere, Univ, Uganda	MSc	Nov 14 – Aug 15
Maria Klerfelt Johansson	F	Sweden	Tanzania	Per Hillbur	University of Gothenburg	BA	Mar 14 – Sept 14
Marcus Bengtsson	M	Sweden	Tanzania	Per Hillbur	University of Gothenburg	BA	Mar 14 – Sept 14
	M	Tanzania	Tanzania	Adebayo Abass	SUA	MSc	2013-2014
Chacha Nyangi (iAGRI)	M	Tanzania	Tanzania	Fen Beed	SUA	MSc	2013-2014
John Joseph Malley	M	Tanzania	Tanzania	Fen Beed	SUA	MSc	2014-2015
Leonard Joseph Marwa	M	Tanzania	Tanzania	Ben Lukuyu	SUA	PhD	2014-2017
Alphonse Haule	M	Tanzania	Tanzania	Ben Lukuyu	SUA	MSc.	2014-2015
Mawazo Shitindi (iAGRI)	M	Tanzania	Tanzania	Mateete Bekunda	Tuskegee, USA	PhD	2013-2016
Gregory Sikumba	M	Zambia	Tanzania	Ben Lukuyu	University of Nairobi	PhD	2013-2016
Michelle Hockett	F	USA	Malawi	Robbert Richardson	MSU	MSc	2013_14
Alex Smith	M	USA	Malawi	Sieg Snapp & Regis Chikowo	MSU	MSc	2013_14
Edward Mzumara	M	Malawi	Malawi	Regis Chikowo & Wezi Mhango	LUANAR	MSc	2013_14
Soflet Mwafulirwa	F	Malawi	Malawi	Agnes Mangwela	LUANAR	MSc	2013_14
Erin Anders	F	USA	Malawi	Sieg Snapp & Regis Chikowo	MSU	PhD	2013-16
Justin Chipomho	M	Zimbabwe	Malawi and Zimbabwe	Regis Chikowo & Sieg Snapp &	University of Zimbabwe	PhD	2013-16
Anita Kaleba		Zambia	Zambia		UNIZA		
John Banda		Zambia	Zambia		UNIZA		

END.